Appendix G
Velocity Estimation Based on Field Observations

G-1. General

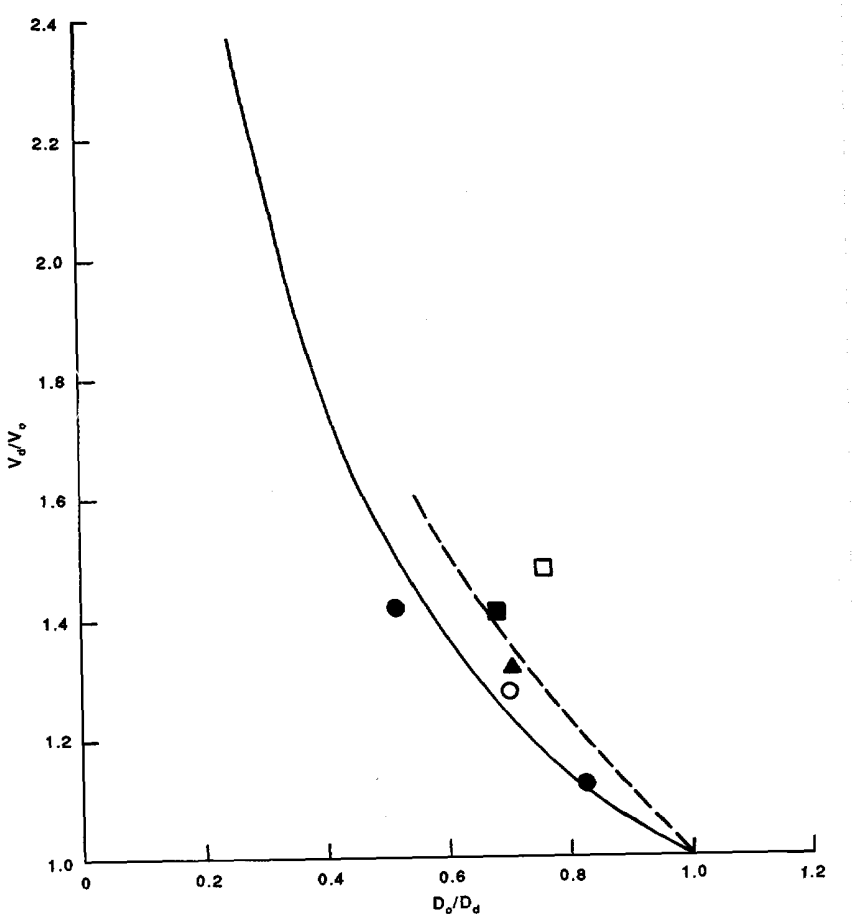
Another means of velocity estimation is based on field observations. Depth-averaged velocities at stages less than design stages are used to estimate depth-averaged velocities at design conditions. Limited data supporting this concept and the analytical relationship based on Manning's equation are shown in Plate G-1. These data were taken from a channel model bend having riprapped bed and banks (1V on 2H side slope) and from channel bends on the Sacramento River having 1V on 2H side slopes. More data are needed and it is almost certain that the lower the stage at observation, the poorer the estimate of velocities at the design conditions.

G-2. Relationship of Surface and Depth-Averaged Velocities

In conjunction with the extrapolation of depth-averaged velocities, tests were conducted to determine the relationship between surface velocities and depthaveraged velocities. Based on model and field results taken in channel bends near the downstream end of the bends, the depth-averaged velocity was roughly 85 percent of the surface velocity. For the purpose of estimating velocities for riprap design, the surface velocities should be taken at various distances from the natural bank until the maximum is found. A complicating factor results from the fact that after an eroding bank is protected, the depth along the outer bank increases, which results in an increase in velocity. Techniques are not available to define this increase. A 25 percent increase is proposed until data become available.

G-3. Example

For example, suppose that at the time of observation of an eroding bank, the thalweg depth is approximately 15 ft. If the maximum surface velocities are determined to be 6 ft/sec, then the depth-averaged velocity for the observed condition will be 0.85(6) = 5.1 ft/sec. If the thalweg depth at design conditions is 25 ft, then from Plate G-1 (using the design curve), the design velocity will be 1.5(5.1) = 7.7 ft/sec. This velocity should then be increased by 25 percent to account for the increase in velocity after the bank is protected. The design velocity is 1.25(7.7) = 9.6 ft/sec. It is obvious that many site-specific factors can cause this method to yield velocities that are substantially in error. Use of this method is recommended only when no other techniques for determining velocity are available.



LEGEND

D_o = OBSERVED DEPTH (OVER TOE)
D_d = DESIGN DEPTH (OVER TOE)
V_d = DESIGN VELOCITY (DEPTH AVERAGED)
V_o = OBSERVED VELOCITY (DEPTH AVERAGED)

- RIPRAP TEST FACILITY
- MANNING'S EQUATION -n = 0.030
- SACRAMENTO RIVER (C-1)
- SACRAMENTO RIVER (C-2)
- SACRAMENTO RIVER (T-4)
- SACRAMENTO RIVER (T-3)
- DESIGN CURVE

RIPRAP DESIGN VELOCITY ESTIMATION
BASED ON OBSERVED
PROTOTYPE VELOCITY

PLATE G-1